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## Report to the Government

of the

## UNITED ARAB REPUBLIC

on

# CEREAL RUST INVESTIGATIONS IN THE SOUTHERN REGION



FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Rome, 1958

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REPORT TO THE GOVERNMENT

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ON

CEREAL RUST INVESTIGATIONS IN THE

SOUTHERN REGION

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Rome, 1958



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## I. INTRODUCTION

In accordance with a request of the Government of the United Arab Republic for technical assistance in the investigations of cereal rusts in the Southern Region, the Food and Agriculture Organization of the United Nations, under its Expanded Technical Assistance Program, appointed Dr. K. Hassebrauk as an expert in plant pathology to advise and assist the Government in its program for wheat rust research and control. Particular attention was given to the establishment of a regular survey for physiologic races of the three wheat rusts and the production of epiphytotics with prevailing races in the wheat breeding centers at Giza, Alexandria and Bahtum. Efforts were made to organize the survey on a regional basis, covering the whole Near East and neighboring areas.

The expert served in the country from 28 January to 1 July 1958. During his assignment, he received the most cordial cooperation from the officials of the Ministry of Agriculture. His work was performed mainly at the Experiment Station at Giza, in cooperation with Dr. T. Abdel Hak, Head of the Section of Cereal Diseases, to whom the expert sincerely expresses his gratitude. The expert also enjoyed the cooperation of the scientific staff of the Plant Breeding Department, especially Mr. A. F. M. El Sayed and Dr. S. M. Dessouky. His work was greatly facilitated by having the opportunity of visiting Upper and Lower Egypt several times to examine the cereal rust situation and to see the excellent wheat breeding work in progress at various stations.

## II. THE RUST PROBLEM

Some years ago losses of wheat due to black stem rust in the Southern Region (Egypt) were estimated at about 10 percent each year. But through the successful development by the Plant Breeding Department of a number of high yielding wheat varieties resistant to stem rust, the losses due to this cause have been largely prevented. For instance, in 1958 only slight stem rust infection has been observed. However, a sudden epidemic may occur at any time when new aggressive physiologic races appear and such has happened in the past in America, Australia and Germany to a disastrous extent. In the Near East, the first appearance of race 11 in 1957 in rust samples collected in Egypt, and of race 15 in Iran and Iraq is regarded as remarkable and alarming.

At present leaf rust and stripe rust are threatening the Egyptian wheat crop. During the last four years, these two rusts have increased gradually and to certain extent they infect some of the valuable varieties resistant to stem rust. In 1958 at some places of Lower Egypt very heavy leaf rust infection was already observed in February. During March and April spread of leaf rust to Middle Egypt was seen. Stripe rust, on the other hand, did not appear at the old infection centers in Upper Egypt, but some varieties in the rust nursery of Giza were heavily infected. It also appeared for the first time at Beni Suef. It should be emphasized that stripe rust is a non-predictable species. It is possible that heavy epidemic may break out suddenly after having disappeared for some years.

Although it is impossible to report the exact losses of leaf and stripe rust which occurred during the past years under various conditions it may be concluded from the expert's observations made during his surveys that the losses amount to about 5 percent in average.

It is well known that efficient and economic control of cereal rusts can be achieved only through the development of resistant varieties. The task of breeding resistant varieties is made more difficult because of the occurrence of physiologic races varying in virulence on different host varieties. Therefore, in order to carry out a breeding program on a sound basis, it is necessary to know the distribution of physiologic races in Egypt as well as in neighboring countries in the Near East and Africa. The races occurring in the neighboring countries today may be introduced into Egypt and become important in the future.

For the determination of physiologic specialization of wheat rust, it is highly desirable to search for supplemental differential varieties among the varieties cultivated at Giza. This is important especially for leaf rust, because most of the differential varieties originally selected by Johnston and Mains are not suitable for local use. The same probably should be done also for stripe rust, as the races of this rust appearing in the hot climate are possibly biologically different from the races found in North Europe.

The races isolated and identified should be continually cultivated or preserved in such a manner that adequate inoculum would be available whenever required. This is essential for all wheat crosses must be tested for reactions to those races during the seedling stage in the greenhouse as well as later stages in the rust nursery. The most promising wheat selections and varieties should be sown at different times, for instance at the intervals of two weeks, to determine their susceptibility at various stages of development. For field tests, sowing the plants in rows and plots as adopted at Giza gave good results and due to the climatic condition it is more preferable than the "stove-pipe" method used in North Europe. Likewise the Giza method of producing epiphytotes by spreaders is satisfactory. It is suggested that the high susceptible variety Michigan Amber should be tested as an additional spreader.

As the weather in Egypt is too hot most time of the year for the testing of stripe rust, consideration may be given to establish stripe rust nurseries in mountainous areas in the Region of Syria.

As cereal rust problem is an international one, results obtained from rust race identification should be made available to pathologists and breeders working on cereal improvement in other countries through the publication of such results in scientific journals and through personal contacts. It is also desirable to hold meetings of rust research workers of Africa, Europe and the Near East. In addition, information on reactions of different wheat varieties to rusts and seeds of promising varieties should be exchanged for mutual benefit.

In connection with wheat breeding, it is also essential to secure better knowledge on the epidemiology and ecology of the three wheat rust species and their races. The sources of primary rust infection in Egypt are still unknown. There are many questions to be answered. For instance, can the rusts oversummer on principal or secondary host plants in Egypt, or the primary infection always originates from air-borne spores from other countries? Are the Egyptian races identical

with races occurring in neighboring countries in the important biological characteristics ? Are the races which occur in Egypt adapted to peculiar temperatures and humidity conditions ? Do alternate host plants (Berberis, Thalictrum) exist in Egypt or neighboring countries ? What are the ecological requirements of prevalent Egyptian races ?

For rust research it is essential to have at Giza, in addition to a laboratory, at least three well equipped greenhouses and three well trained rust specialists with a sufficient number of technical assistants. It is not only inadvisable to work on three different rust species side by side in a greenhouse, but it is also impossible to carry out by one man exhaustive researches simultaneously on more than one rust species.

Every rust species requires particular environmental conditions. Stripe rust is exceedingly heat sensitive and may be cultivated on cereal seedlings only in a cool greenhouse. Greenhouses used for cultivating leaf rust and stem rust also need cooling and shading equipment, in order that investigations may be continued during the hot summer months.

Since it is normally impossible to cultivate simultaneously a great number of rust races, it is necessary to preserve uredospores under suitable conditions in order to prolong their longevity for further inoculation use to achieve that suitable equipment is required.

### III. SUMMARY OF ACCOMPLISHMENTS

During his assignment, the expert studied the situation of wheat rusts in Egypt, discussed various problems with technical staff responsible for cereal diseases and cereal breeding in the Ministry of Agriculture, and examined research facilities available. He advised the plant pathologist in charge of rust work of research techniques in use in the Institut für Botanik, Brunswick, which are different from those being used at Giza. The Brunswick method is less liable to mistakes where the technical personnel performing the work is not well-trained or is not constantly supervised.

The expert initiated the identification of physiologic races of leaf rust from samples collected during 1957/58. So far only race 144 was identified, and rust samples have been sent to Brunswick for verifying the results.

Since the existing greenhouses at Giza are not suitable for stripe rust work, samples of this rust collected in both Egypt and Afghanistan have also been sent to Brunswick for identification.

Arrangements were also made with the Institut für Botanik, Brunswick, for exchange of seeds of wheat varieties and selections which may be useful in breeding. Seeds of approximately 80 Egyptian varieties and crosses were sent to Brunswick for testing their reactions to stripe rust. Several spring wheat varieties which showed high resistance to both leaf and stripe rusts at the rust nursery in Brunswick during past years were obtained and forwarded to the Plant Breeding Department at Giza for inclusion in the breeding program. A similar arrangement was made with Dr. J. C. Santiago of the Estação de Melhoramento de Plantas, Elvas, Portugal, who is actively engaged in stem rust investigations.

In order to have a better knowledge on the distribution and prevalence of physiologic races of wheat rusts in the Near East, agricultural institutions in the region were requested to communicate important epidemiological data and to send rust samples to Giza for identification.

During the several trips made in the Region, the epidemiology of wheat rusts was studied. It was found that wild grasses even neighboring to heavily infected wheat plants were never infected.

Apparently they are not hosts of cereal rusts. Furthermore, alternate hosts Berberis and Thalictrum were not seen anywhere.

A plan for improvement of the staff and facilities for cereal rust studies was formulated in order that effective investigations can be carried out to obtain adequate knowledge on physiologic races. Design and cost estimations of the proposed refrigerated greenhouse were obtained and have been submitted to the Ministry of Agriculture for reference.

#### IV. RECOMMENDATIONS

1. It is recommended that two plant pathologists with post-graduate training and several technical assistants be added to the staff of the Plant Pathology Section of the Ministry of Agriculture to work on leaf rust and stripe rust of wheat. In view of the magnitude of work involved in the survey of physiologic races of the three wheat rusts on a regional basis, it is highly desirable to have a plant pathologist working only on one rust species. Dr. T. Abdel Hak, who is in charge of cereal diseases and is responsible for wheat stem rust investigations, may assume the over-all responsibility of supervising the work on all the three rusts and he should be given an opportunity, through FAO fellowship or otherwise, to visit the Institut für Botanik, Brunswick, in order to get acquainted with the research techniques in use there. Fellowships also should be arranged for other young plant pathologists to gain more experience in this special field. Laboratory assistants should be adequately trained for carrying out routine work and consideration may be given to train women for this type of task.

2. It is recommended that a refrigerated greenhouse be built for stripe rust investigation. Since stripe rust is extremely heat sensitive, wheat seedling can be successfully infected only at about 16-20° C. Consequently a greenhouse suitable for stripe rust investigations must be provided not only with the usual shading but also with a temperature-regulating unit to keep the temperatures sufficiently low under the prevailing climatic conditions.

In order to know the approximate costs for the construction of a greenhouse with a temperature-regulating unit, the expert requested two German firms for quotations. Accordingly the firm Gustav Röder of Hannover submitted a design of a greenhouse and quoted a price of DM 14,369 (approximately US\$ 3,420) for materials required and DM 3,800 (approximately US\$ 900) for assembling. The firm Sigma-Frigo-Therm of Mannheim quoted a price of DM 39,700 (approximately US\$ 9,450) for a complete temperature-regulating unit and DM 5,000 (approximately US\$ 1,200) for the installation. The design of the greenhouse as well as the quotations have been submitted to the Ministry of Agriculture for reference.

3. It is recommended that in order to increase the usefulness of the two existing greenhouses, satisfactory shading and cooling facilities be introduced. Although leaf and stripe rusts can endure

rather higher temperatures, the two greenhouses now available for rust work, one with unsatisfactory shading and the other without shading, cannot be used for several months a year because of high temperatures. Even in March, the temperature inside the greenhouse may reach 45° C. or higher, which can kill the rust as well as seedlings. In order to make the greenhouses available for investigations for a longer period each year, it will be necessary to provide them with shadings of the Venetian blind type and also with a suitable means of cooling. To drizzle the greenhouse roofs from outside with water would somewhat lower the temperature inside the greenhouse. The use of Sirocco exhaust fans is not recommended because the air drift would cause heavy contaminations if infected plants are maintained on open greenhouse benches as it is customarily done at Giza.

4. It is recommended that other facilities for rust investigations also be improved, to increase efficiency of the work. The most urgent requirements include the installation of gas in the head house for sterilization, cooking and other uses, the provision of one additional refrigerator in the laboratory for preservation of rust samples, and the provision of lyophilization apparatus for preserving viable uredospores. Lyophilization is an effective method to keep uredospores viable for long periods and its adoption will save space, labour and expenses. In addition, an English typewriter is needed for maintaining correspondence with rust workers in other countries.



